Amendments to the Drawings:

The attached sheet of drawings includes changes to FIGURE 2. In original FIGURE 2, two reference numerals "61B" inadvertently appeared by a drafting error. The attached substitute sheet corrects that error, and changes the reference numeral "61B" appearing in the upper right hand area of the FIGURE 2 to correctly appear as "61A". FIGURE 2 is a "PRIOR ART" drawing and this correction has no effect on the disclosed invention subject to this Application. Antecedent bases for the correction is found in the specification at page 7, lines 13 - 22.

REMARKS / ARGUMENTS

In response to the First Office Action of December 1, 2005, Applicants have amended independent claims 1 and 7, and have added a new set of claims numbered 8 - 14. Reconsideration and allowance of the pending, amended claims are respectfully requested.

I. Invention Overview

A fuel cell of the present application includes a membrane electrode assembly having a first reactant flow field secured adjacent a first and/or a second surface of the assembly for directing flow of a first reactant adjacent the first and/or second surface of the assembly. The first reactant flow field defines a plurality of two-pass circuits, and each two-pass circuit is in fluid communication with a first reactant inlet for directing the first reactant into the fuel cell and with a first reactant outlet for directing the first reactant out of the fuel cell.

Additionally, the reactant flow field defines a common turn-around in fluid communication with all of the two-pass circuits and between the reactant inlets and outlets of the circuits. Therefore, the first reactant passing from a reactant inlet to a reactant outlet of one two-pass circuit mixes within the common turn-around with the first reactant passing through the other two-pass circuits. The plurality of two-pass circuits

facilitates water movement within porous layers defining the reactant flow field from adjacent the reactant outlet toward the reactant inlet to humidify the incoming first reactant to thereby aid in passive maintenance of fuel cell water balance.

II. Response to Office Action

By the December 1, 2005 First Office Action, the Examiner first rejected claim 5 under 35 U.S.C. 112, second paragraph. By the present Amendment, claim 5 has been amended to include the language suggested by the Examiner to resolve this matter. The undersigned thanks the Examiner for his attention to detail.

Next, the Examiner has rejected the only independent claims 1 and 7, and dependent claims 3 - 5 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,981,098 to Vitale. In particular, the Examiner asserted that Figure 5 of Vitale shows a "plurality of pass circuits [240] in communication with reactant inlets [222'/150'] and outlets 244'/150']." Applicants appreciate that Vitale shows similar structure to Applicants' claimed invention. However, Applicants stress that while Vitale shows similar structure, in essence Vitale seeks to accomplish substantially distinct functions from Applicants' invention, and hence, while Vitale shows some similar structure, by the present amendments to independent claims 1 and 7, and by new claims 8 - 14, distinguishing structure has been amended into Applicants' now pending claims to thoroughly distinguish Applicants' "Fuel Cell With Passive Water Balance" over Vitale's "Fluid Flow Plate

for Decreased Density of Fuel Cell Assembly".

Vitale's primary goal is to decrease density of the fluid flow plate wherein the fluid flow plates are made of metal. At Col. 7, line 5 - Col. 8, line 1, Vitale discusses manufacture of the disclosed plate, and it is clear that the various embodiments may be made of "corrugated stock/fin/foil/sheet material" (Vitale at Col. 7, lines 5-6). Additionally, an exemplary material for all or part of the flow plate is "thin stainless steel stock" (Vitale at Col. 7, lines 17-18). At Col. 8, line 39, Vitale points out that a layer adjacent the flow plate is an "interposed member 234" that "can be formed by etching stainless steel."

The channels (Vitale, Reference No. 216) formed in such non-porous flow plate material of Vitale serve to direct flow of fuel cell product water, condensate or reactant fluids. Vitale points out that the individual channels must be formed to maintain integrity of flow within each channel to avoid mixing with fluids in adjacent channels 216. For example, at Col. 9, lines 12 starting at lines 12 - 20, Vitale recites:

> Desirably, sidewalls 252 prevent communication or mixing between fluids carried in adjacent flow channels 216. In particular, it is desirable to ensure the integrity of each reactant flow channel 216 in order to maintain adequate pressure drop along the flow channel. Namely, one wishes to prevent liquid

(e.g., humidification and/or product water) from resting, aggregating, or otherwise obstructing or plugging the flow channel.

To achieve that goal, Vitale uses sealed, non-porous channels 216. Additionally, Vitale's "through turns 246" are likewise sealed to prevent such described mixing of fluid within the channels 216 in both the embodiments described in Figures 1-4, as well as in the Figure 5 embodiment that used reference numeral 246' for the turns. The reason the Vitale Figure 5 embodiment uses several separate circuits instead of the long, serpentine channels 216 of Figures 1 - 4 is to facilitate manufacture of the "strip 250'" (that define the reactant inlets and outlets) and the "end section 242'" (that define the turns 246). "Thus, one may form a given end section 242', or any desired portion strip 250', with potentially fewer restrictions from stretchability and/or extension limitations of the constituent material (e.g., stainless steel foil)." (Vitale, at Col. 8, lines 62-66.)

Consequently, to achieve its many goals, Vitale uses sealed channels 216, 216' that maintain their integrity through sealed turns 246, 246' to prevent "mixing," "resting" or "aggregating" of humidification and/or product water or reactant fluids.

In contrast, the primary goal of Applicants' "Fuel Cell With Passive Water Balance" is to facilitate movement of water through porous layers that define reactant flow channels so that

dry reactant fluid entering the fuel cell through reactant inlets adjacent "evaporation zones" are passively humidified by movement of water from "condensation zones" adjacent reactant outlets. The water moves through porous layers that define the channels within the reactant flow fields. As recited in Applicants' specification at page 9, line 32 - page 10, line 18.

> As shown in FIG. 3, in contrast to FIG. 2, there is a relatively short distance between a reactant stream passing within the first pass 102 adjacent directional arrow 104 and a reactant stream within the second pass 106 adjacent directional arrow 108 of the first two-pass circuit 82. That decreased distance between the first and second passes 102, 106 facilitates movement of water within porous layers adjacent the first and second passes 102, 106, as represented by the water movement arrow 112. Consequently, the multiple two-pass circuits 82, 84, 86, 88 facilitate movement of water within the porous layers defining the first reactant flow field 80 so that adequate water remains within the porous layers adjacent the first reactant inlet 90 and reactant inlets of the other two-pass circuits 84, 86, 88 as the reactant is entering the first reactant flow field 80. As is known in the art, the channels, dividers and separators that may be utilized to define the first reactant flow field 80 are typically defined within common porous layers of the components of the

fuel cell 12, such as in the coolant flow plate 34 and adjacent cathode flow field 20…. (Emphasis added.)

Because Applicants goals are substantially distinct, the specification discloses structure that is neither shown nor suggested in Vitale. First, by the present amendment to claims 1 and 7, Applicants have included the "common turn-around 96" as a necessary element of those independent claims. Antecedent bases for that amendment are found in the drawings, at Figure 3, reference numeral 96, and in the specification at page 9, lines 15, 16 which states: "All of the two-pass circuits may pass through a common turn-around 96". It is stressed that the "turn-around 96" is a common turn-around, meaning that the turn-around is "common" to all of the two-pass circuits, so that reactant streams passing through each of the plurality of two-pass circuits pass through the "common turn-around". Because each of the plurality of two-pass circuits does not have its own, isolated turn-around, the reactant streams passing through the "common turn-around 96" necessarily mix with each other. That the "common turn-around 96" is not segregated into separate turn-arounds is emphasized in the two-way arrows shown within the schematic description of the "common turn-around 96" in Figure 3, as well as in the above quoted language from Page 9, line 14, 16 of the specification.

Vitale does not include such a structure as a "common turn-around", and more importantly, Vitale expressly teaches away from any such common turn-around that would disrupt the

"integrity" of each flow channel and provide for mixing of the fluids flowing through adjacent channels, as described in the above quotes from Vitale. Consequently, by the present amendments to independent claims 1 and 7, Vitale no longer shows each and every element of Applicants' claimed invention of claims 1 - 7. As recited in the Manual of Patent Examining Procedure at Sec. 2131: "To anticipate a claim, the reference must teach each and every element of the claim." By the present amendment, because Vitale no longer teaches each and every element of Applicants' invention subject to claims 1 - 7, it is requested that Vitale be removed as a reference in rejecting those claims.

With respect to new claims 8 - 14, as described above, to achieve its goals, Applicants' invention facilitates "movement of water within the porous layers defining the first reactant flow field 80…." (Specification at page 10, lines 7-9.) Therefore, new claims 8 - 13 are virtually the same as original claims 1 - 6, except that the "first reactant flow field (80)" of independent claim 8 is characterized as defining "a plurality of two-pass circuits (82, 84, 86, 88) (as in original claim 1), which two-pass circuits are "<u>defined within porous layers of the flow field (80),</u>…." (The amendatory language is underlined.) New claim 14 depends from new independent claim 8 adding an additional limitation of the above described "common turn-around" of amended claim 1. Antecedent bases for the addition to original claim 1 to form new claim 8 is found in the aforesaid part of the specification at page 10, lines 6 - 9, as

well as at page 10, lines 2 - 5, which describes the "movement of water within porous layers adjacent the first and second passes 102, 106 as represented by the water movement arrow 112." This "water movememnt arrow 112" emphasizes the primary goal of Applicants' invention of passive water movement from the "first and second passes 102, 106" of the two-pass circuit 82, "within porous layers" adjacent to and defining the two-pass circuit.

In contrast, and as described above, Vitale achieves its goals of maintaining adequate pressure drop within its channels without mixing of fluids within adjacent channels through use of channels defined by non-porous materials, preferably stainless steel. Moreover, Vitale expressly teaches away from using porous materials to define its channels because Vitale, as described above, teaches that it is necessary to prevent the mixing or aggregating of fluids within the channel. Applicants, however, seek almost the opposite effect. Applicants' porous layers that define the two-pass circuits of new claims 8 - 14 seek to move aggregated, excess water out of the channels adjacent the reactant outlets so that the water moves through and mixes with water from adjacent channels in moving toward the reactant inlet.

Therefore, by the presentation of independent claim 8, and its dependent claims 9 - 14, all of which require "two-pass circuits defined within porous layers of the flow field", Vitale no longer shows or suggests all of the elements of Applicants' new independent claim 8. As described above in reference to the

Manual of Patent Examining Procedure, "To anticipate a claim, the reference must teach each and every element of the claim." Vitale does not show or suggest "two-pass circuits" for directing flow of a reactant that are "defined within porous layers" of a flow field. Therefore, it is respectfully requested that Vitale not be asserted as a basis for rejecting new claims 8 - 14.

Next, the Examiner has rejected claim 2 and 6 under 35 U.S.C. 103(a) as being obvious in light of Vitale. The undersigned appreciates the Examiner's position and detail in comparing the dimensional characteristics of Vitale to those claimed in claims 2 and 6. However, by the present amendment to independent claim 1 as described above, it is urged that Vitale no longer shows all of the elements of claim 1 and that therefore Vitale should be removed as a reference thereby making claim 1 allowable. Because claim 1 is now allowable in light of the amendment thereto, claims 2 and 6 simply narrow an allowable claim, and hence should be allowable as well. Additionally, if Vitale is removed as a reference for claim 1, it also should be removed as a reference for claims 2 and 6 for the same reasons.

The undersigned points out that in reviewing the Application, a minor error was observed in Figure 3. By this Amendment, a substitute sheet 2 has been submitted to replace original sheet 2. The attached sheet of drawings includes changes to Figure 2. In original Figure 2, two reference

numerals "61B" inadvertently appeared by a drafting error. The attached substitute sheet corrects that error, and changes the reference numeral "61B" appearing in the upper right hand area of the FIGURE 2 to correctly appear as "61A". FIGURE 2 is a "PRIOR ART" drawing and this correction has no effect on the disclosed invention subject to this Application. Antecedent bases for the correction is found in the specification at page 7, lines 13 - 22.

III. Conclusion

By the present amendment to original claim 1 and to bring in new claims 8 - 14, it is urged that the pending claims are now in condition for allowance. Accordingly, it is respectfully requested that the Examiner issue a Notice of Allowance.

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Date: 3/1/2006